based. New claims 39 – 82 focus on the preferred embodiments of the present invention and better distinguish over the cited prior art.

Independent claims 39 (apparatus) and 61 (method) recite that each heat transfer/heat exchange conduit is substantially symmetrically surrounded by a longitudinally continuous, sleeve-shaped baffle structure having symmetrically positioned upstream and downstream apertures so as to isolate fluid flow around the associated heat transfer conduit from fluid flow around transversely adjacent heat transfer conduits in order to establish a substantially uniform fluid flow pattern around each heat transfer conduit.

Support for focusing on these preferred embodiments of the present invention, in which each heat transfer conduit has its own associated sleeve-like baffle structure to preferentially contour the cross-wise fluid flow path around that particular conduit, is found at page 7, line 21 to page 8, line 5 of the Specification. Additional support for the amended claims is found in the Summary of the Invention (pages 5 – 9) and in Figs. 2A, 3, 5, 6, 7 and 8 (as discussed in the Specification, each heat transfer conduit shown in the conduit arrays of Figs. 5 and 6 may include an associated apertured sleeve-like baffle structure – see Specification page 17, lines 2 –3 and lines 18 – 19). As taught at page 8, lines 3 – 5 of the Specification: "Apertured sleeves of this type at least partially surrounding individual heat exchange conduits in an array of such conduits have been found to enhance heat transfer by a factor of about five times or more."

The Written Opinion of August 13, 2001 during Chap. II proceedings in the corresponding PCT application cited the Ohsaki et al. (U.S. Pat. No. 4,594,227) and Dijt (U.S. Pat. No. 3,616,849) patents, specifically observing that "Dijt teaches cross-wise fluid flow paths for the purpose of increasing the heat transfer rate between the fluid and the

tubes." The Dijt patent further shows (Fig. 4) a type of baffle assembly for channeling fluid flow. The Ohsaki et al. '227 patent fails to show or suggest any type of baffle structure.

The present invention as herein claimed is distinguished from the Ohsaki et al. '227 and Dijt '849 patents in providing a very different, sleeve-shaped baffle system to substantially symmetrically surround each heat exchange conduit in an array of such conduits. The baffle system of the present invention differs from that shown in Dijt '849 in a number of important respects. First, Fig. 4 of Dijt does not show a baffle assembly which can be said to "substantially surround" any of the Dijt heat exchange conduits, as called for in independent claims 39 and 61. Second, Fig. 4 of Dijt does not provide a baffle assembly that comprises a lateral wall along each side of a heat exchange conduit. Therefore the Dijt design does not result in "isolating cross-wise fluid flow around that associated heat transfer conduit from cross-wise fluid flow around adjacent heat transfer conduits located transversely to the direction of fluid flow..." as called for in independent claims 39 and 61.

Third, the design in Fig. 4 of Dijt does not show "fluid flow apertures ... symmetrically located respectively upstream and downstream of the associated heat transfer conduit..." as recited in independent claims 39 and 61. Even assuming that the structure shown in Fig. 4 of Dijt could reasonably be interpreted as comprising both "upstream" and "downstream" flow constrictors, they are clearly not "symmetrically" located relative to a heat exchange conduit located between them because the "upstream" baffle element in Fig. 4 of Dijt '849 is clearly spaced farther from the conduit than is the "downstream" baffle element. This asymmetrical positioning results in a non-uniform fluid flow pattern around the conduit, as is clearly shown by the fluid flow arrows in Fig. 4 of Dijt. A fairer interpretation of Fig. 4 of Dijt would be to recognize that the Dijt structure provides <u>only</u> a

downstream flow constrictor for each heat exchange conduit and does not provide an upstream flow constrictor in any meaningful sense of this term. Thus, there is no suggestion in either the Ohsaki et al. '227 patent or in the Dijt '849 patent of a fluid flow contouring apparatus and method as claimed herein.

The Sakuma et al. '919 patent cited in the accompanying Information Disclosure Statement recently came to Applicants' attention. Sakuma '919 is directed to a fin-and-tube heat exchanger somewhat similar in appearance and operation to an automobile radiator. A set of parallel fin plates (reference numeral 2 in Fig. 1 of Sakuma '919) channel fluid flow cross-wise across heat exchange tube 1, which is formed into a serpentine shape. Louvers 4, 5, 6 and 7 (Fig. 2 of Sakuma '919) are formed by slitting and bending these elements from the fin plates 2 such that they project alternately from opposite surfaces.

The stated objective of the Sakuma '919 patent is to improve heat transfer performance by minimizing the stagnant fluid zone which is conventionally generated behind (downstream) of the heat exchanger tube (see Fig. 24 - Prior Art of Sakuma '919). By contrast, in the heat exchanger according to the Sakuma '919 patent, "the rising ends of the louvers are slanted at an angle to the flow direction of the fluid which can smoothly direct the fluid flow behind the heat exchanger tube to prevent the fluid flow from detaching itself from the tube."

Although the louvers of Sakuma '919 clearly result in a certain type of contouring of fluid flow around the various sections of heat exchange tube 1, the structure, objective, and result of the Sakuma '919 design all differ dramatically from the present invention. More particularly, Sakuma '919 clearly does <u>not</u> teach or suggest the concept of substantially surrounding a heat exchange conduit with an apertured, sleeve-shaped, longitudinally

continuous shell, as taught by the present invention, in order to isolate cross-wise fluid flow around each heat exchange conduit. In addition, louvers 4, 5, 6 and 7 projecting alternately from opposite fin plate surfaces do <u>not</u> provide a longitudinally continuous surface because these louvers are associated with separate fin plates and are not joined at the centerline between adjacent fin plates 2. The upstream louver configuration is <u>not</u> symmetrical with the downstream louver configuration (i.e., louvers 6 and 7 explicitly differ in shape from louver 5 to create an asymmetrical flow pattern), and the flat sides of the louvers do <u>not</u> conform to the curved shape of the heat exchange tube.

Another significant difference is that in the heat exchange design of Sakuma et al. '919, substantial portions of the cross-wise fluid flow can and do bypass one or even all of the multiple layers of heat exchange tubes, as seen for example in Fig. 5 and even more clearly in Fig. 17. Little if any of the fluid flow in Sakuma '919 ever directly contacts more than one section of heat exchange tube 1; and, as can be seen in Fig. 17, some portion of the fluid flow may never contact any part of tube 1. In Sakuma '919, however, some heat exchange appears to occur from fluid contacting fin plates 2 (which are connected to heat tube 1 by fin collars 3), even if that fluid bypasses direct contact with tube 1. Thus, preventing any fluid from bypassing the heat tube sections in Sakuma '919 would not be desirable and, in fact, would likely be impossible or render this system inoperable.

By contrast, the preferred sleeve-shaped baffle system of the present invention is expressly designed so as to prevent any fluid from bypassing any layer of heat exchange conduits (see, e.g., Figs. 2A and 3 of the present invention). Because all of the fluid flow in the present invention contacts every layer of heat exchange conduits, and because the fluid flow around each heat exchange conduit is preferentially contoured in accordance with this

invention, the result is to produce a process stream that is heated/cooled both efficiently and with an extremely high degree of thermal uniformity. This makes such a process stream highly desirable for use in carrying out downstream chemical reactions where isolated "hot" spots or "cold" spots in a process feed could seriously degrade performance or product quality. The heat exchange system of Sakuma '919 is neither intended for nor able to achieve such a result.

SUMMARY AND CONCLUSIONS

For all of the foregoing reasons, claims 39 – 82 now pending should be deemed patentable.

Accordingly, this application is now considered to be in condition for allowance, and an early indication of same is earnestly solicited.

Respectfully submitted,

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David Silverstein

David Silverstein
Registration Number 26,336
Attorney for Applicants
Andover-IP-Law
44 Park Street, Suite 300
Andover, MA 01810
Telephone: (978) 470-0990
Facsimile: (978) 470-0993